



# **Advanced Planning and Integration Capability Roadmap Development**

## ***Science Instruments and Sensors***

***Rich Barney: NASA Chair***

**NASA Capability Roadmap Public Outreach Workshop**

**November 30, 2004**

**Mayflower Hotel, Washington, DC**



# Agenda

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- Background
  - Charter
  - Strategic Capability Requirements
- Roadmap Development
  - Team Membership
  - Capability Breakdown Structure
  - Development Process Flow
  - Product Development Plan
- Science Instruments & Sensors Public Meeting



# Science Instruments and Sensors Capability Roadmap Team

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- Capability Roadmap Team Charter
  - *During this phase, technical experts both internal and external to NASA will provide the technical knowledge and expertise in the development of roadmaps which identify the capabilities that are needed to meet the missions of the Agency. The capability roadmap team will identify and analyze each of the associated technologies and assess the capability performance afforded by the current state of the art, the performance level needed by the strategic mission and trace the development required.*
- *Science Instrument and Sensor Capability Roadmap Team Charter*
  - *The Science Instrument and Sensor Capability Roadmap Team will investigate current NASA exploration and science measurement strategies, mission concepts, and science instrument/sensor technology roadmaps to assess state-of-the-art technology development needs and identify critical science instrument capability gaps. This information will be integrated with extensive national science and engineering community input to develop capability roadmaps that will identify key technologies required to meet the NASA Vision for Space Exploration. Priority consideration will be given for instrument and sensor component technologies that (1) achieve goals closely aligned with Vision and (2) constitute a major advance and/or enable a large number of science instruments, sensors or goals.*



# Strategic Capability Requirements

## Solar System

Robotic and Human exploration of the Moon & Mars

Sustained program of solar system exploration

Advanced telescope searches for Earth-like planets and habitable environment

## Example Mission Needs

Comet Surface Sample Return

Europa Lander/Pathfinder

Robotic and Human Lunar Missions

Mars Exploration Reference Missions

## Earth-Sun System

Determine how living Earth System is affected by internal dynamics, and understand implications for life.

Explore the Sun-Earth system to understand effects on Earth and implications for human exploration.

## Example Mission Needs

Global Precipitation

Decadal Measurements of Ice Mass

Global Troposphere Winds

Earth-Sun Design Reference Missions

**Science  
Instruments  
and Sensors**

## Universe

Explore the origin, evolution, structure, and destiny of the Universe

How do galaxies form and evolve?

Are we alone?

## Example Mission Needs

Laser Interferometer Space Antenna

James Webb Space Telescope

Einstein Missions

Single Aperture Far-Infrared Observatory

Universe Design Reference Missions



# Science Instruments and Sensors Capability Roadmap Team

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- **Chair:** Rich Barney (NASA/GSFC)
- **Co-Chair:** Dr. Maria Zuber (MIT)
- **Deputy:** Juan Rivera (NASA/GSFC)

## **NASA Members**

- Dr. Brian Ramsey (MSFC)
- Dr. Bruce Spiering (Stennis)
- Dr. Tim Krabach (JPL)
- Dr. Soren Madsen (JPL)
- Dr. Paul Mahaffy (GSFC)
- Dr. Azita Valinia (GSFC)
- Dr. Craig McCreight (ARC)

## **Federally Funded Research Center Members**

- David L. Glackin (Aerospace)

## **Industry Members**

- Dr. David Chenette (LM)
- Dr. Ron Polidan (NGST)
- Dr. Rich Dissly (Ball)

## **Academia Members**

- Dr. Chris Ruf (University of Michigan)
- Dr. Steve Ackerman (University of Wisconsin)
- Dr. Richard McEntire (APL)
- Dr. Jonas Zmuidzinas (Cal Tech)

## **Ex-officio Members**

- Dr. Carl Stahle (GSFC-Nano CRM)
- Louis Barbier (NASA-SEU Technologist)
- Thomas Black(NRO)
- Amy Walton (ESTO)

•Team members were chosen from a list of 70 recommended candidates based on their technical expertise, instrument development experience, and willingness to participate in NASA strategic planning.



# Capability Breakdown Structure (*Draft*)

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- **Active & Passive Microwave Technologies**
  - Active & Passive Antennas
  - Active & Passive Electronics
  - Precision Thermal Control
  - Data Processing
  - MEMS/Nano
  - Data Processing
  - Calibration Targets/Systems
- **Imaging Systems**
  - Detectors
  - Precision Scan Mechanisms
  - Optics
  - Cryogenic Mechanism
  - Precision Thermal Control
  - Active/Passive Thermal Systems
  - Structures & Metrology
  - Readout Electronics
  - Data Processing
- **Laser/LIDAR Systems**
  - Laser transmitter
  - Diodes
  - Cavity Optics
  - Fiber Laser
  - Laser/Optical Amplifiers
  - Frequency Doubling/Conversion
  - Electro-Optics
  - Receivers
  - Detectors
  - Instrument Electronics
  - Pointing / Tracking Systems
  - Thermal Management Systems
- **Spectrometer/Spectrograph Systems**
  - Cryo Linear Scan Mechanisms
  - Detectors/Multiplexers
  - Optics
  - Cryogenic Systems
  - Miniaturized Systems
  - Data Processing



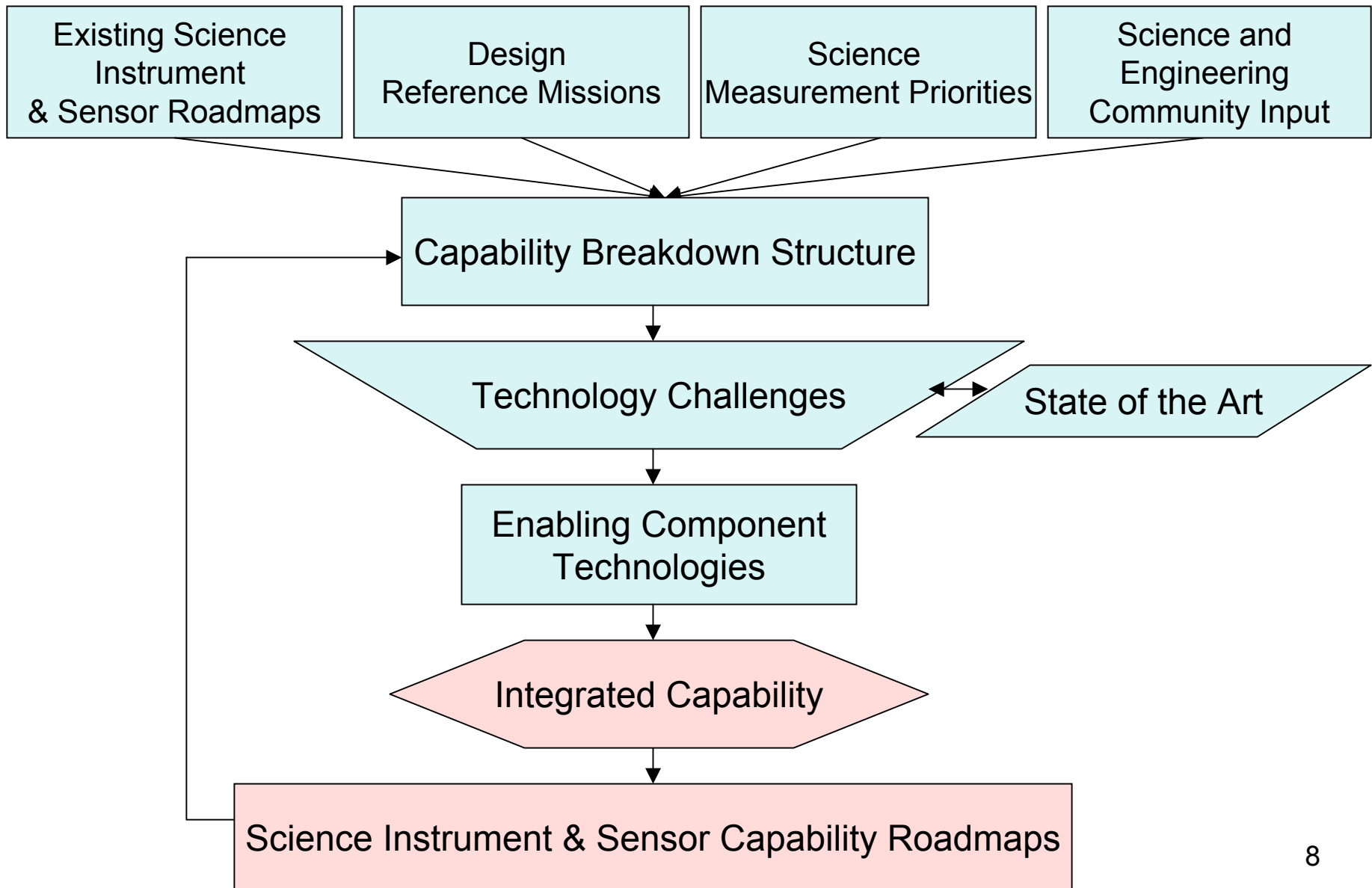
# Capability Breakdown Structure (*Draft*)

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- **Fields, Waves and Particle Detection**
  - MEMS
  - Nano
  - Detectors
  - Amplifiers
  - Electron Sources
  - ASICs
  - Pumps/ Valves
  - Data Processing
- **Bioastronautic Sensors**
  - Radiation Dosage
  - Life monitoring instruments (heart rate, temperature, blood pressure, etc.)
  - MEMS
  - Nano
  - Data Processing
- **Surface Sample Acquisition and Analysis**
  - MEMS
  - Nano
  - Detectors
  - Amplifiers
  - Electron Sources
  - ASICs
  - Pumps/ Valves
  - Drilling technology for collection of samples
  - Cryogenic Sample Preservation and Handling Technology
  - Age Determination and Compositional Analysis Technology
  - Data Processing



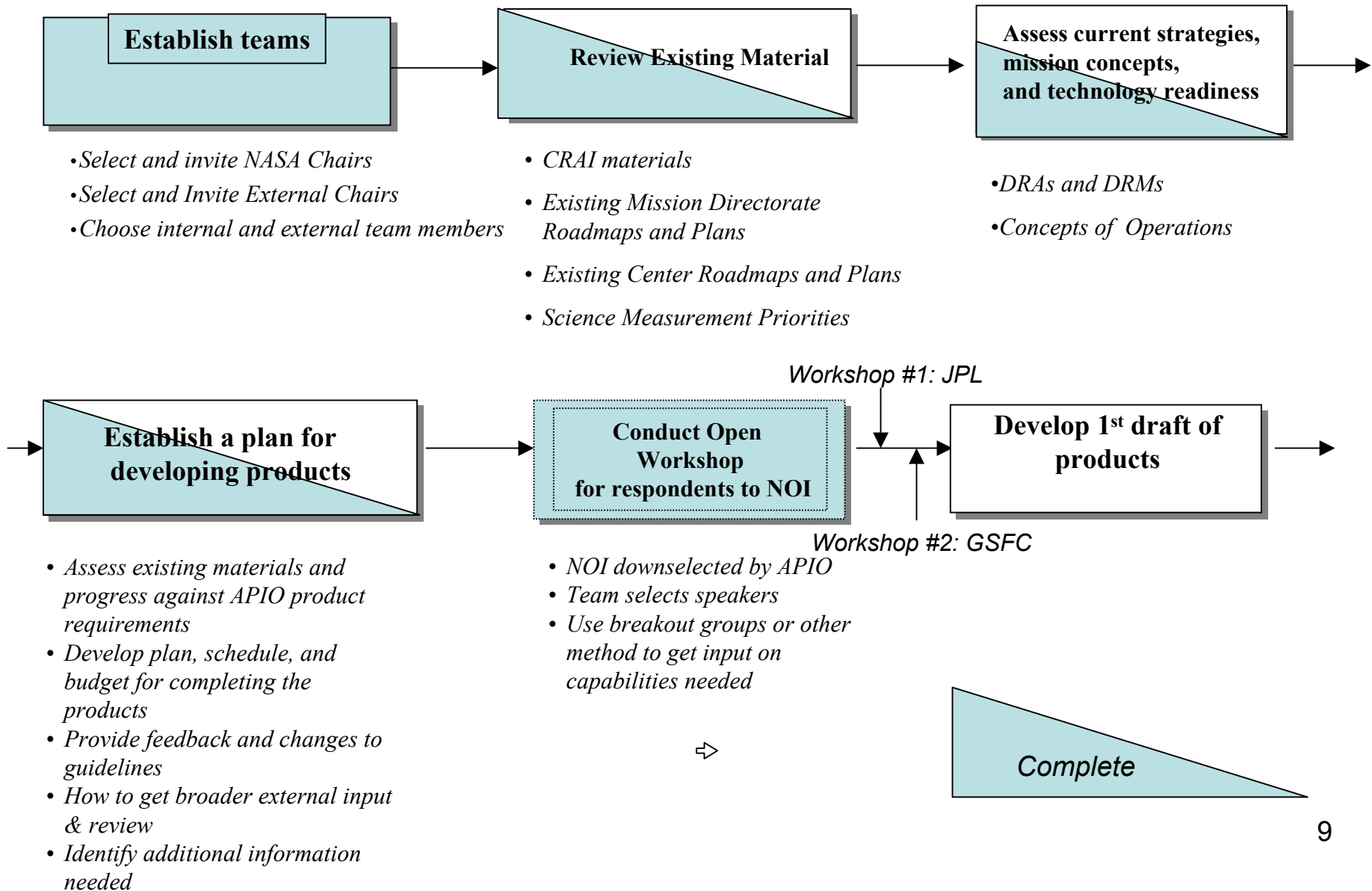
# Capability Roadmap Development Approach







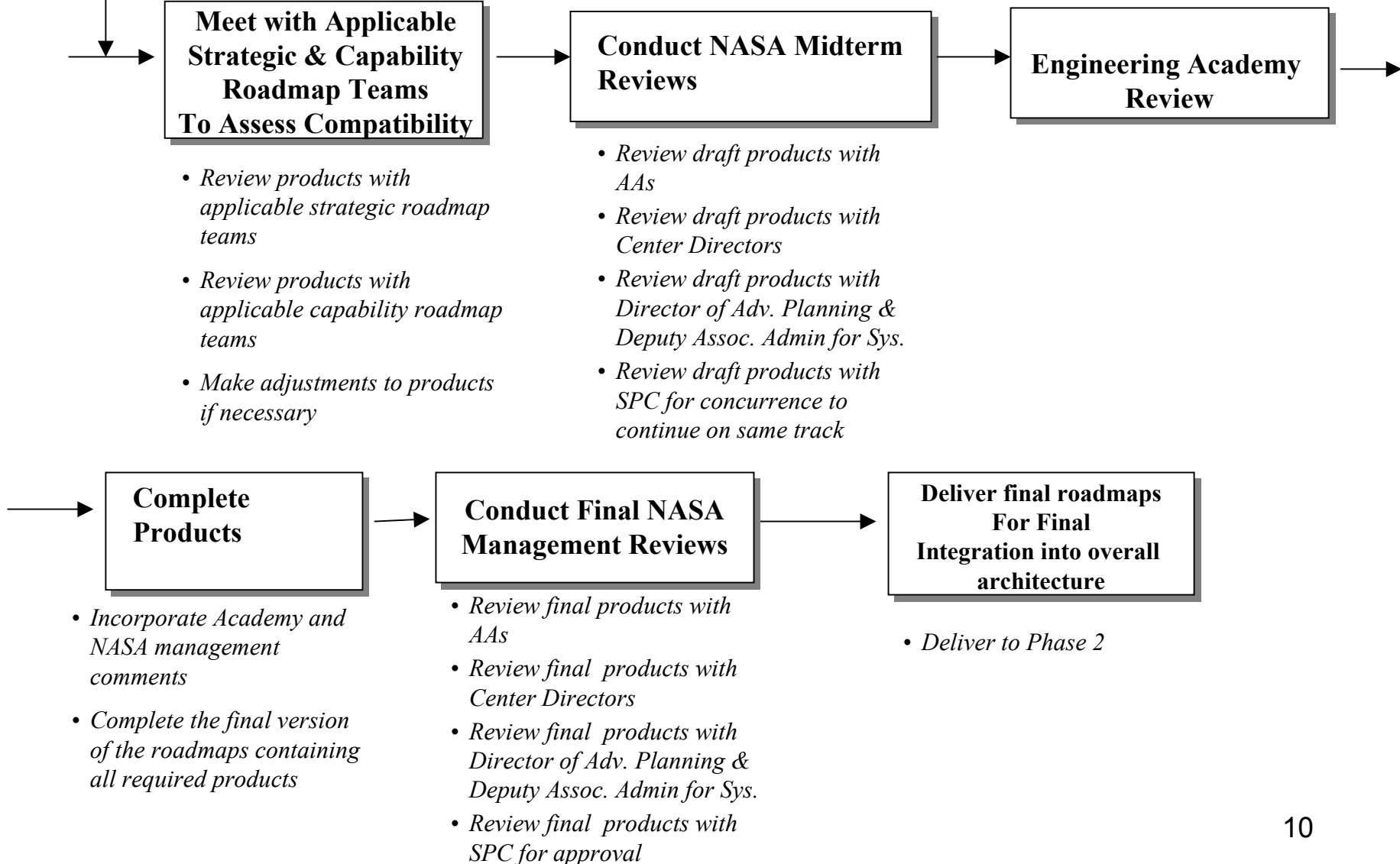
# Process Flow for Capability Roadmap Development





# Process Flow for Capability Roadmap Development

Workshop #3: MIT





# Events and Schedule

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- **Nov. 19-23: Team notified and finalized**
- **Nov 22: Kickoff telecon**
- *Nov 23-Dec. 8: Assessment of Existing Roadmaps*
- *Nov 23-Dec. 8: Review Design Reference Missions*
- *Nov. 30: Public Meeting*
- Dec. 2: Planning telecon for first workshop
  
- ***Dec 8-9: First workshop (2 days – JPL)***
  - Initial Team Meeting
  - Existing Roadmap Review
  - Design Reference Mission Review
  - Establish Subtopic Teams
  - Capability Breakdown Structure
  - CRM Product Planning
  - Science and Engineering Community Input
  
- ***Jan 6-7: Second workshop (2 days – GSFC)***
  - Subtopic Team Reports
  - CRM Product Planning
  - Capability Breakdown Structure
  - Roadmap Crosswalk
  - Science and Engineering Community Input
  
- ***Feb 2-3: Third workshop (2 days – MIT)***
  - 1st Draft Roadmap Review
  - Set Final Product for HQ POP Cycle
  - Science and Engineering Community Input
  
- Mar 7: Report delivery for NAE review



# Science Instruments & Sensors Public Meeting

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- 112 individuals are registered to participate in the Science Instruments and Sensors Public Roadmap Session:
  - 61 “Non-NASA” Registrants
  - 51 “NASA” Registrants
- 65 White Papers have been submitted to the Science Instrument and Sensors Public Roadmap Session:
  - 28 “Non-NASA” Papers
  - 37 “NASA” Papers
- 46 individuals have registered to participate AND submitted one or more white papers:
  - 14 “Non-NASA”
  - 32 “NASA”
- 22 White Papers will be presented today:
  - 14 “Non-NASA”
  - 8 “NASA”
- The Science Instruments and Sensors Capability Roadmap Team will review all submitted papers.